

Chemistry	Group-I	Paper-I
Time: 1.45 Hours	(Subjective Type)	Marks: 48

(Part-I)

2. Write short answers to any Five (5) questions: 10

(i) Define organic chemistry.

Ans → Organic chemistry is the study of covalent compounds of carbon and hydrogen (hydrocarbons) and their derivatives.

(ii) What is mole?

Ans → A mole defined as the amount (mass) of a substance that contains 6.02×10^{23} number of particles (atoms, molecules or formula units). It establishes a link between mass of a substance and number of particles. It is abbreviated as 'mol'.

(iii) What do you mean by carbon dating?

Ans → An important method of age determination of old carbon containing objects (fossils) by measuring the radioactivity of C-14 in them is called radio-carbon dating or simply carbon dating.

(iv) Write isotopes of chlorine.

Ans → There are two isotopes of chlorine, $^{35}_{17}\text{Cl}$ and $^{37}_{17}\text{Cl}$.

(v) Define Avogadro's Number.

Ans → Avogadro's Number is a collection of 6.02×10^{23} particles. It is represented by symbol ' N_A '. Hence, the 6.02×10^{23} number of atoms, molecules or formula units are called Avogadro's number. It is equivalent to one 'mole' of respective substance. In simple words, 6.02×10^{23} particles are equal to one mole as twelve eggs are equal to one dozen.

(vi) What is difference between Mendeleev's Periodic Law and Modern Periodic Law?

Ans → Mendeleev's periodic law states as "Properties of the elements are periodic functions of their atomic

masses." While the modern periodic law is based upon the arrangement of elements according to increasing atomic number.

(vii) Define electron affinity.

Ans Electron affinity is defined as

"The amount of energy released when an electron is added up in the outermost shell of an isolated gaseous atom."

(viii) What is trend of atomic radius in period and group?

Ans Trend in a Group:

The size of atoms or their radii increase from top to bottom in a group. It is because a new shell of electrons is added up in the successive period, which decreases the effective nuclear charge.

Trend in a Period:

When we move from left to right in a period, although atomic number increases, yet the size of atoms decreases gradually. It is because with the increase of atomic number, the effective nuclear charge increases gradually because of addition of more and more protons in the nucleus. But, on the other hand, addition of electrons takes place in the same valence shell i.e., shells do not increase. There is gradual increase of effective nuclear charge which increases due to addition of protons. This force pulls down or contracts the outermost shell towards the nucleus. For example, atomic size in period 2 decreases from Li (152 pm) to Ne (69 pm).

Q.3. Write short answers to any Five (5) questions: 10

(i) Write two properties of covalent compounds.

Ans Two general properties of covalent compounds are as follows:

1. They have usually low melting and boiling points.
2. They are usually bad conductors of electricity. The compounds having polar character in their bonding

are conductors of electricity when they dissolve in polar solvents.

(ii) Ionic compounds are solid. Explain.

Ans → Ionic compounds in solid state have negligible electrical conductance but they are good conductors in solution and in the molten form. It is due to presence of free ions in them. Ionic compounds are made up of positively and negatively charged ions. Thus they consist of ions and not the molecules. These positively and negatively charged ions are held together in a solid crystal form with strong electrostatic attractive forces.

(iii) Define non-polar covalent bond and give one example.

Ans → If a covalent bond is formed between two similar atoms, the shared pair of electrons is attracted by both the atoms equally. Such type of bond is called non-polar covalent bond. These bonds are formed by equal sharing of electron pair between the two bonding atoms. This type of bond is called a pure covalent bond. For example, bond formation in H_2 and Cl_2 .

(iv) Define hydrogen bonding and give one example.

Ans → The partially positive hydrogen of one molecule attracts and forms a bond with the partially negatively charged atom of the other molecule, the bonding is called as hydrogen bonding.

Hydrogen bonding greatly affects the physical properties of the molecules. Due to this, the boiling point of the compounds are greatly affected. For example, the boiling point of water ($100^\circ C$) is higher than that of alcohol ($78^\circ C$). This is due to more and strong hydrogen bonding in water.

(v) Why the density of gases increases on cooling? Explain.

Ans → The density of gases is increased by cooling. Because on cooling, the volume of the gases decreased.

(vi) Define standard atmospheric pressure.

Ans Standard atmospheric pressure is the pressure exerted by atmosphere at sea level.

(vii) Define diffusion and give one example.

Ans Diffusion is defined as spontaneous mixing up of molecules by random motion and collision to form a homogeneous mixture. Diffusion depends upon the molecular mass of gases. Lighter gases diffuse more rapidly than heavier ones. e.g., H₂ diffuses four times faster than O₂ gas.

(viii) What is meant by freezing point?

Ans When liquids are cooled, the vapour pressure of the liquid decreases and a stage reaches when vapour pressure of a liquid state becomes equal to the vapour pressure of the solid state. At this temperature, the liquid and solid coexist in dynamic equilibrium and this is called as 'freezing point' of a liquid.

Q.4. Write short answers to any Five (5) questions: 10

(i) Write two differences between colloid and suspension.

Ans

Colloid	Suspension
1. Particles are large but can't be seen with naked eye.	1. Particles are big enough to be seen with naked eye.
2. Although particles are big but they can pass through a filter paper.	2. Solute particles cannot pass through filter paper.

(ii) What do you mean by % -mass/mass?

Ans Percentage - $\frac{\text{Mass}}{\text{Mass}} \left(\% \frac{\text{m}}{\text{m}} \right)$:

It is the number of grams of the solute in 100 grams of solution. For example, 10% m/m sugar solution means

that 10 g of sugar is dissolved in 90 g of water to make 100 g of solution.

$$\% \text{ by mass} = \frac{\text{Mass of solute (g)}}{\text{Mass of solute (g)} + \text{Mass of solvent (g)}} \times 100$$
$$= \frac{\text{Mass of solute (g)}}{\text{Mass of solution (g)}} \times 100$$

- (iii) Identify a strong and weak electrolyte among the following compounds: CuSO_4 , Ca(OH)_2 , HCl , HNO_3

Ans Strong electrolytes:

1. CuSO_4
2. HCl
3. HNO_3

Weak electrolyte:



- (iv) Write two differences between electrolytic and galvanic cell.

Ans Comparison of Electrolytic and Galvanic Cell

Electrolytic Cell	Galvanic Cell
1. It consists of one complete cell, connected to a battery.	1. It consists of two half cells connected through a salt bridge.
2. Anode has positive charge while cathode has negative charge.	2. Anode has negative charge while cathode has positive charge.

- (v) Define corrosion.

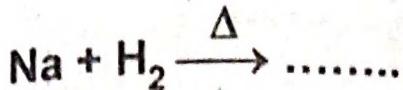
Ans Corrosion is slow and continuous eating away of a metal by the surrounding medium.

- (vi) Write at least two physical properties of magnesium.

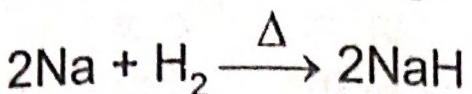
Ans Following are two of the physical properties of magnesium:

1. The physical appearance of magnesium is silvery white and hard.
2. The magnesium is a good conductor of heat and electricity.

(vii) Complete and balance the given chemical equation:



Ans The chemical equation is given below:



(viii) Write down the name of four least reactive metals.

Ans Four least reactive metals are:

- | | |
|-----------|------------|
| 1. Copper | 2. Mercury |
| 3. Silver | 4. Gold |

(Part-II)

NOTE: Attempt any Two (2) questions.

5.(a) Define the following: (5)

- | | |
|------------------------|-------------------|
| (i) Physical Chemistry | (ii) Biochemistry |
| (iii) Element | (iv) Radical |
| (v) Atomic number | |

Ans (i) **Physical Chemistry:**

Physical chemistry is defined as:

"The branch of chemistry that deals with the relationship between the composition and physical properties of matter along with the changes in them."

(ii) **Biochemistry:**

The branch of chemistry in which we study the structure, composition and chemical reactions of substances found in living organisms is called as biochemistry.

(iii) **Element:**

Modern definition of element is that "It is a substance made up of same type of atoms, having same atomic number and it cannot be decomposed into simple substances by ordinary chemical means."

It means that each element is made up of unique type of atoms that have very specific properties.

(iv) Radical:

Radicals are atoms or group of atoms possessing odd number of electrons.

(b)

An

(v) Atomic Number:

The atomic number of an element is equal to the number of protons present in the nucleus of its atoms. It is represented by symbol 'Z'.

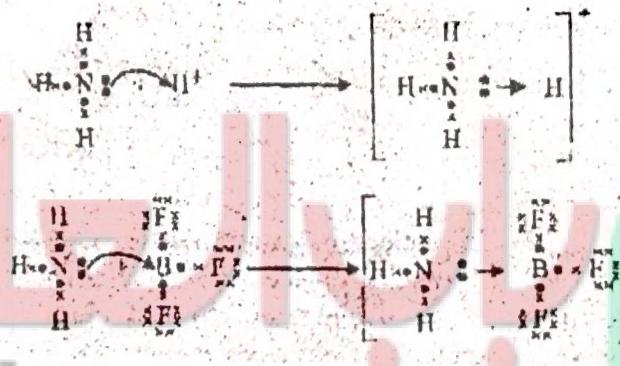
(i)

(b) Write the four properties of Cathode Rays. (4)su
ex

Ans For Answer see Paper 2015, (Group-I), Q.5.(b).

Q.6.(a) How a coordinate covalent bond is formed? Explain with examples. (4)qu
su

Ans Formation of Coordinate Covalent Bond:

sl
(ii)

The non-bonded electron pair available on an atom, like the one available on nitrogen in ammonia, (NH_3) is called a lone pair. When a proton (H^+) approaches a molecule with a lone pair of electrons, that lone pair is donated to H^+ and a coordinate covalent bond is formed, e.g., formation of ammonium radical (NH_4^+).

Explanation:

In the formation of BF_3 (boron trifluoride) molecule, three valence electrons of boron atom ($Z = 5$) pair up with three electrons, one from each three fluorine atoms. The boron atom even after this sharing of electrons (covalent bond formation), remains short or deficit of two electrons in its outermost shell. Now if a molecule with a lone pair approaches this molecule, it accepts lone pair from that donor and forms a coordinate covalent bond.

(b) Define evaporation. How it is affected by different factors? (3)

Ans **Evaporation:**

The process of changing of a liquid into a gas phase is called evaporation.

Evaporation depends upon the following factors:

(i) Surface area:

Evaporation is a surface phenomenon. Greater is surface area, greater is evaporation and vice versa. For example, sometimes a saucer is used if tea is to be cooled quickly. This is because evaporation from the larger surface area of saucer is more than that from the smaller surface area of a tea cup.

(ii) Temperature:

At high temperature, rate of evaporation is high because at high temperature, kinetic energy of the molecules increases so high that they overcome the intermolecular forces and evaporate rapidly. For example, water level in a container with hot water decreases earlier than that of a container with cold water. This is because the hot water evaporates earlier than the cold water.

(iii) Intermolecular forces:

If intermolecular forces are stronger, molecules face difficulty in evaporation. For example, water has stronger intermolecular forces than alcohol, therefore, alcohol evaporates faster than water.

Q.7.(a) Define dilute solution and concentrated solution. How a dilute solution is prepared from a concentrated solution? (5)

Ans **Dilute Solution:**

Dilute solutions are those which contain relatively small amount of dissolved solute in the solution.

Concentrated Solution:

Concentrated solutions are those which contain relatively large amount of dissolved solute in the solution.

Preparation of Dilute Solution:

Dilute molar solution is prepared from a concentrated solution of known molarity as explained below:

Suppose we want to prepare 100 cm^3 of 0.01 M solution from given 0.1 M solution of potassium permanganate. First 0.1 M solution is prepared by dissolving 15.8 g of potassium permanganate in 1 dm^3 solution. Then 0.01 M solution is prepared by the dilution according to following calculations:

Concentrated solution

Dilute solution

$$M_1 V_1 = M_2 V_2$$

$$\text{Where } M_1 = 0.1 \text{ M}$$

$$V_1 = ?$$

And

$$V_2 = 100 \text{ cm}^3$$

$$M_2 = 0.01 \text{ M}$$

Putting the values in above equation, we get

Concentrated solution

Dilute solution

$$V_1 \times 0.1 = 0.01 \times 100$$

$$V_1 = \frac{0.01 \times 100}{0.1}$$

$$= 10 \text{ cm}^3$$

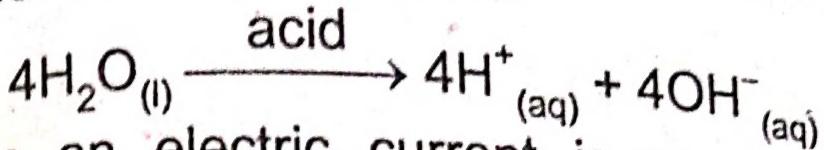
Concentrated solution of KMnO_4 has dense purple colour. Take 10 cm^3 of this solution with the help of graduated pipette and put in a measuring flask of 100 cm^3 . Add water up to the mark present at the neck of the flask. Now it is 0.01 molar solution of KMnO_4 .

- (b) Discuss the electrolysis of water and write down the chemical reactions.** (4)

Ans → Electrolysis of Water:

Pure water is a very weak electrolyte. It ionizes to very small extent. The concentrations of hydrogen ion (H^+) and hydroxyl ions (OH^-) are both at $10^{-7} \text{ mol dm}^{-3}$

respectively. When a few drops of an acid are added in water, its conductivity improves.



When an electric current is passed through this acidified water, OH^- anions move towards positive electrode (anode) and H^+ cations move towards negative electrode (cathode) and discharge takes place at these electrodes. They produce oxygen and hydrogen gases respectively at anode and cathode as shown in the following figure.

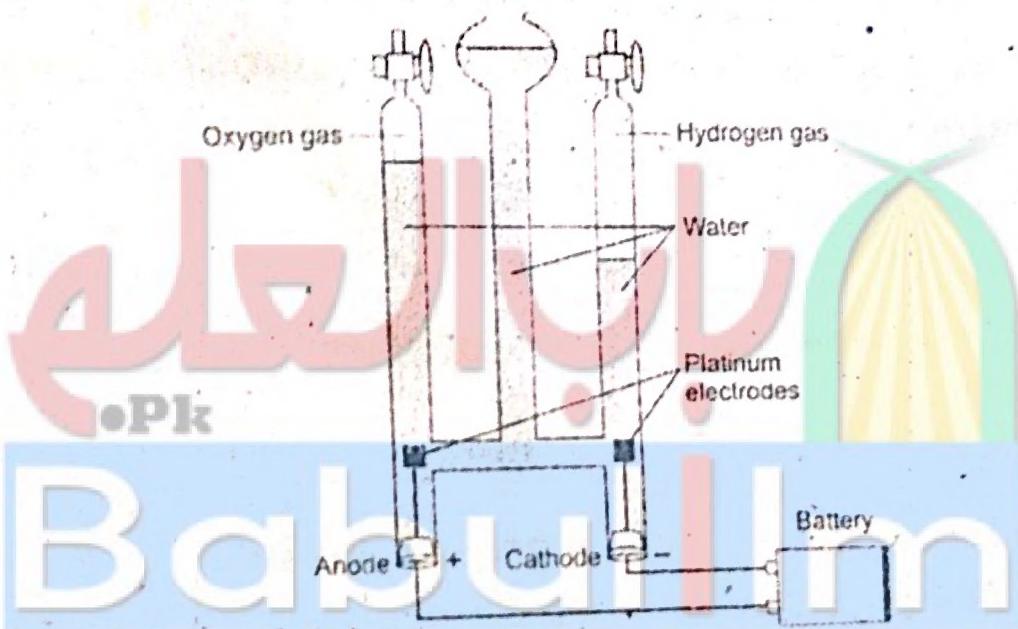
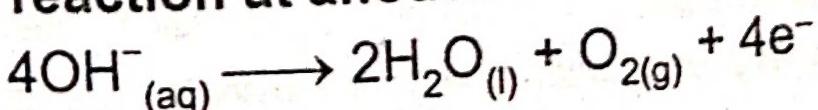
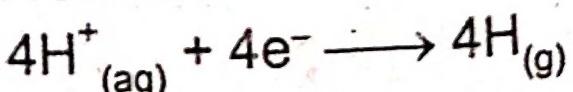


Fig. Electrolytic cell showing electrolysis of water.
The redox reaction taking place in the electrolyte bath can be shown as follows:

Oxidation reaction at anode:



Reduction reaction at cathode:



Overall reaction:

